GROUP 37

POWER STEERING

CONTENTS

GENERAL INFORMATION

M2370000100312

Electric power steering system has been adopted for all models in order to ensure an optimised steering feeling.

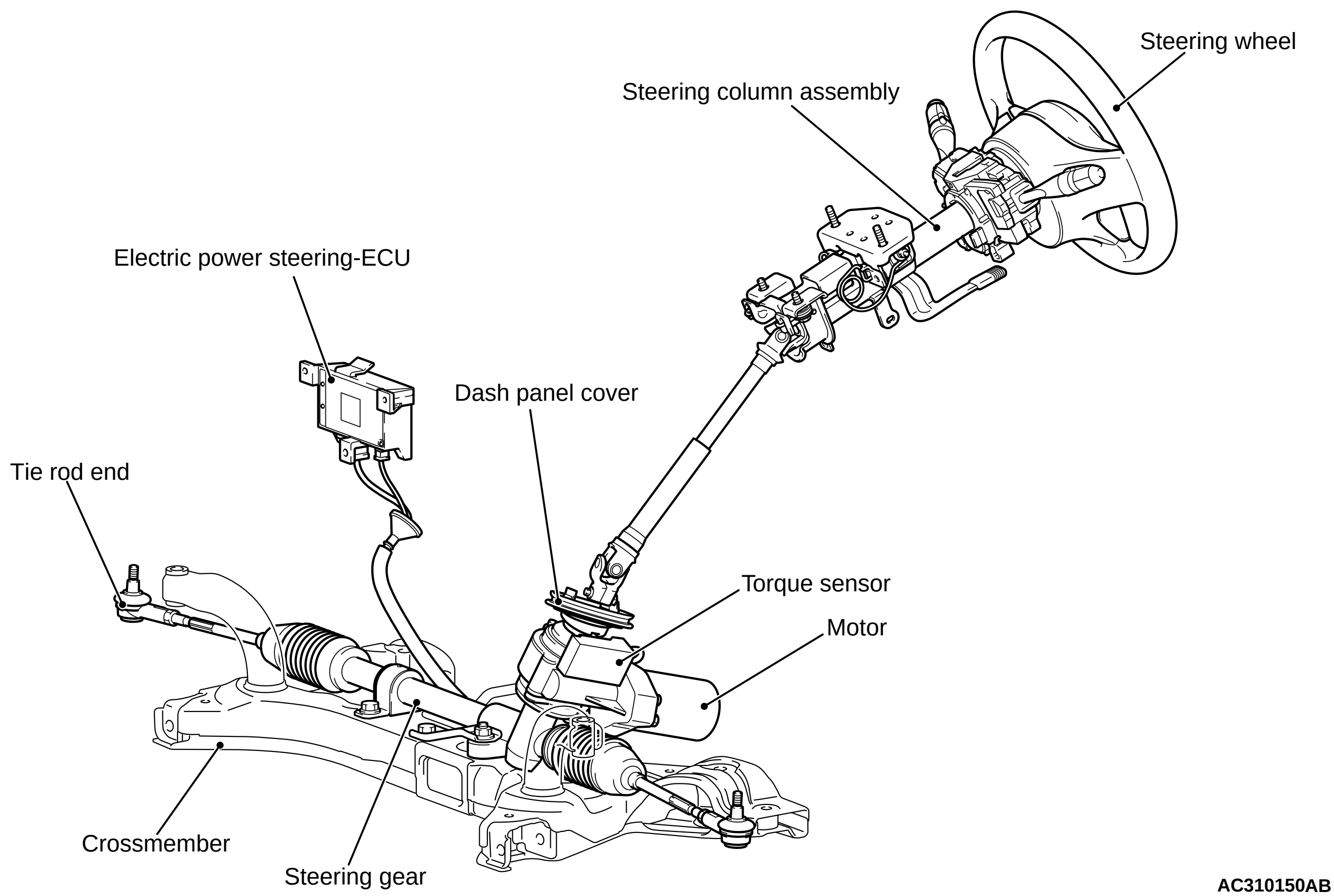
FEATURES

- Improved fuel consumption by reduction of engine load, and weight saving by decrease of the number of parts have been achieved with the introduction of the electric power steering system.
- 3-spoke type steering wheel integrated with an SRS airbag has been adopted.
- Impact-absorbing mechanism and tilt steering mechanism have been adopted.

SPECIFICATIONS

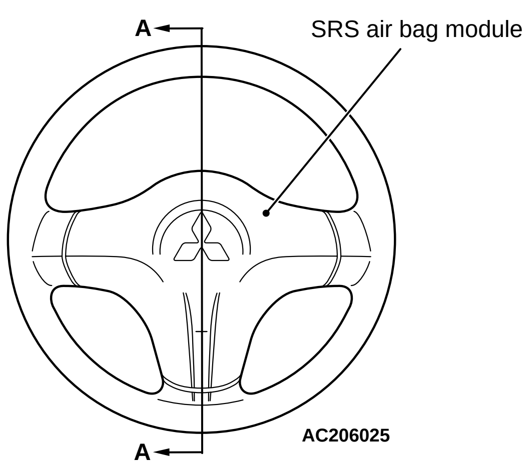
Item		Specification
Steering wheel	Type	3-spoke type
	Outside diameter mm	370
	Maximum number of turns	3
Steering column	Column mechanism	Shock absorbing mechanism and tilt steering mechanism
Power steering type		Electrical powered type
Steering gear	Type	Rack and pinion
	Stroke ratio (Rack stroke/Steering wheel maximum turning radius)	46
	Rack stroke mm	138
Steering angle	Inner wheel	36°40’
	Outer wheel	32°50’

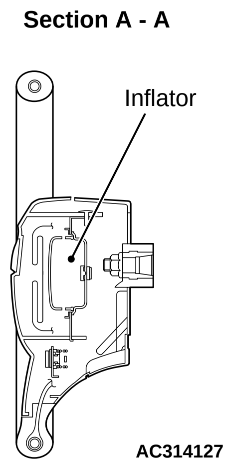
CONSTRUCTION DIAGRAM

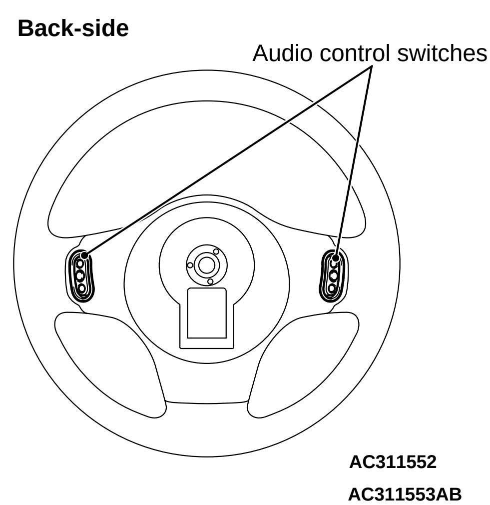


STEERING WHEEL

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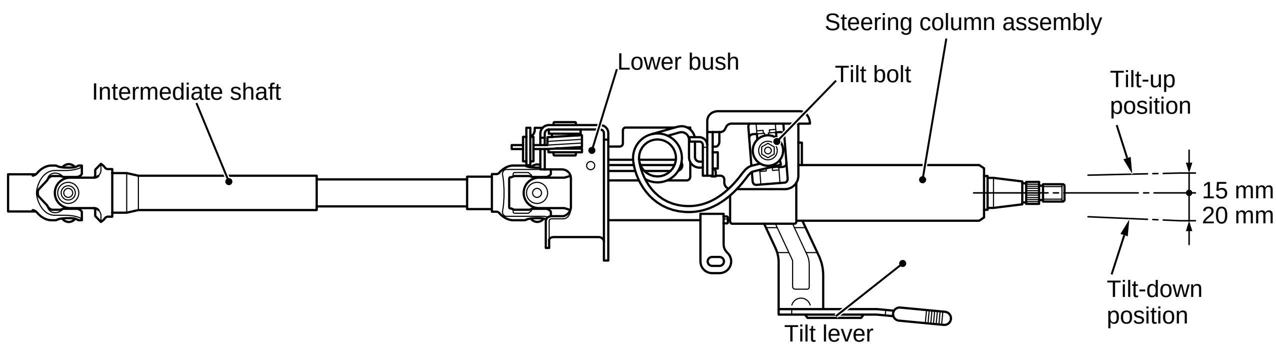
The steering wheel is designed to improve operationality, safety and maintainability and has the following features:

- New 3-spoke type steering wheel which features urethane and genuine leather types has been adopted. The leather steering wheel is optionally available for all models.

- It incorporates an SRS air bag to protect the driver in the event of a frontal collision.
- The air bag module is equipped with an inflator that does not contain sodium azide.
- Audio control switches have been optionally adopted on the backside of the steering wheel for all models.

STEERING SHAFT AND COLUMN

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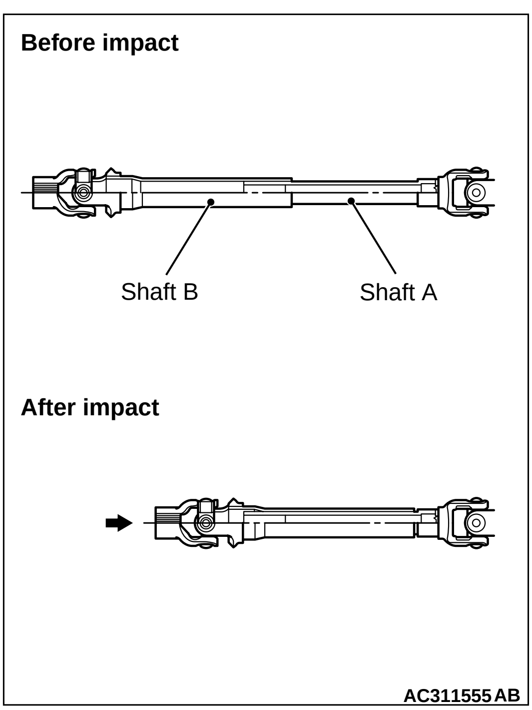


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Tilt steering mechanism allowing desired driving position (tilt-up/tilt-down: 15mm/20mm) has been installed for all models. Additionally, impact-absorbing mechanism has been introduced to the steering column to absorb an impact during collision and protect driver’s safety.

Impact-absorbing mechanism

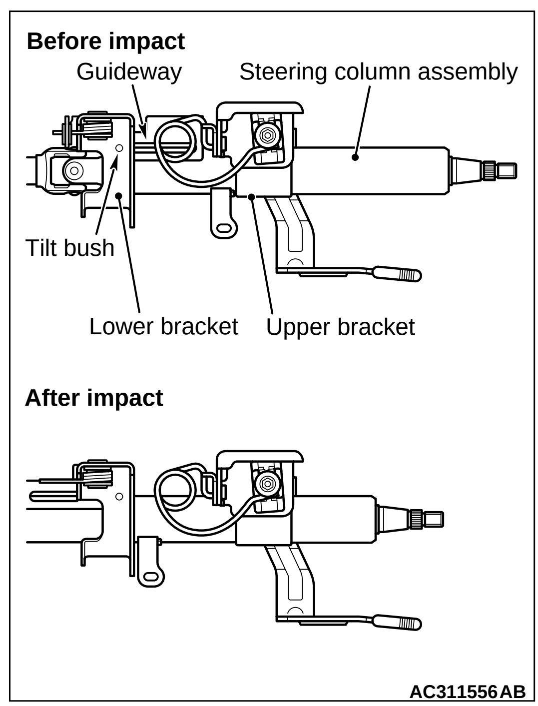
PRIMARY COLLISION



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When a vehicle is crashed and the lower shaft is loaded from the gearbox side, the shaft A is forced into the shaft B to absorb an impact load. Thus, the steering column will not be projected into the passenger compartment to reduce possible chest injuries.

SECONDARY COLLISION



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When the load of the driver’s body is applied to the steering wheel after airbag deployment, the steering column assembly moves forward and down along the tilt bush and guideway while sliding into the upper and lower brackets, absorbing an impact load.

ELECTRICAL POWER STEERING

GENERAL INFORMATION

M2370000100323

Vehicle-speed sensitive electric power steering (whole range type) has been adopted. This system allows a light steering force during stationary steering maneuvre or low speed driving, and a moderate steering force during medium or high speed driving. For vehicles with this system, the electric power steering-ECU controls the motor current according to the vehicle speed and steering force of the steering wheel.

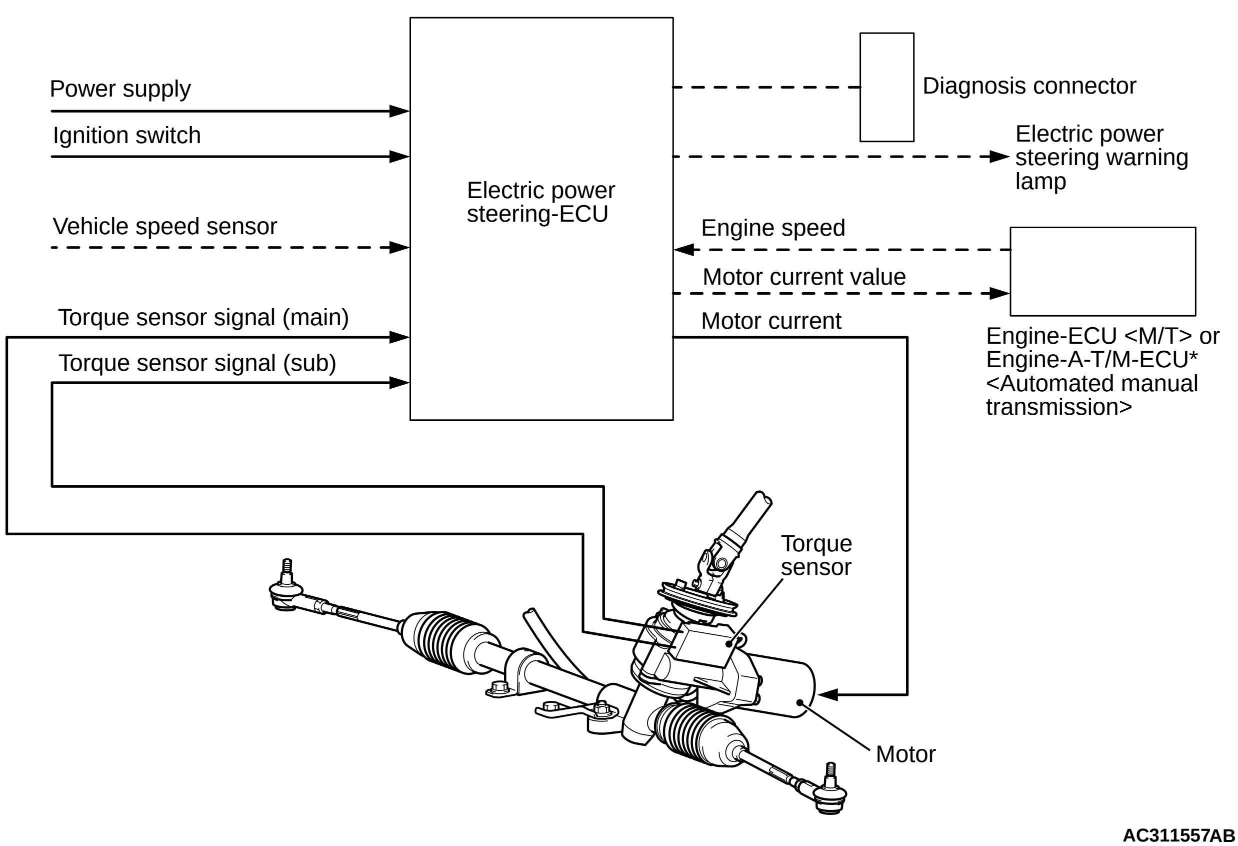
CAN* communication has been adopted in order to communicate with another ECUs for obtaining necessary information related to this control, achieving wiring harness saving and secure data communication.

*NOTE: **: For more information about CAN (Controller Area Network), refer to Group 54C**P.54C-2**.*

SPECIFICATIONS

Item		Specification
Motor	Type	Permanent magnetic field type
	Rated voltage (V)	DC12
	Rated current (A)	50
Torque sensor	Type	Noncontact type (Inductance detection type)
electric power steering-ECU	Control type	Microcomputer control (16 bit)
	Rated voltage (V)	DC12

SYSTEM CONFIGURATION



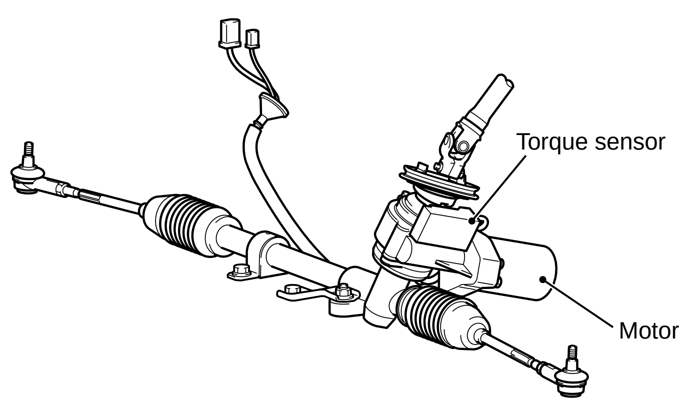
NOTE: Dashed lines indicate CAN-bus lines.

NOTE: Engine-A-M/T-ECU: Engine Automated Manual Transmission Electronic Control Unit*

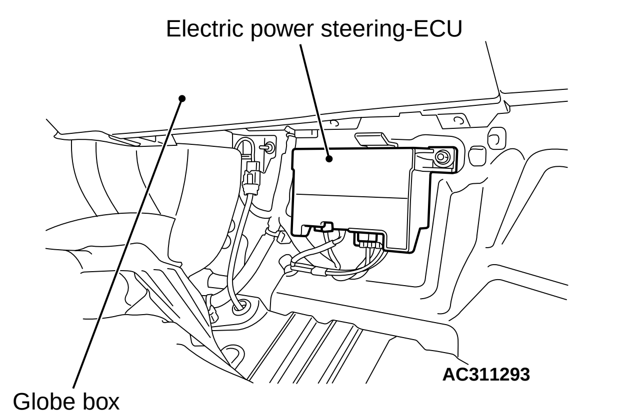
ELECTRICAL PARTS AND FUNCTIONS

Parts Name		Description about functions
Sensor	Vehicle speed sensor (ABS-ECU)	Sends the vehicle speed signal to the electric power steering-ECU.
	Torque sensor	Detects a steering force, converts it into the voltage signal, and then sends the signal to the electric power steering-ECU.
Actuator	Motor	Generates assist torque by the steering operation to the steering gear using the signals sent from the electric power steering-ECU.
	Electric power steering warning lamp	Warns a driver of the system malfunction using the signal sent from the electric power steering-ECU.
electric power steering-ECU		Controls the actuators (motors) based on the signals sent from sensors.
		Controls the self-diagnostic function and fail-safe function.
		Controls diagnostic function (Compatible with MUT-III).

GENERAL DESCRIPTION ON SYSTEM



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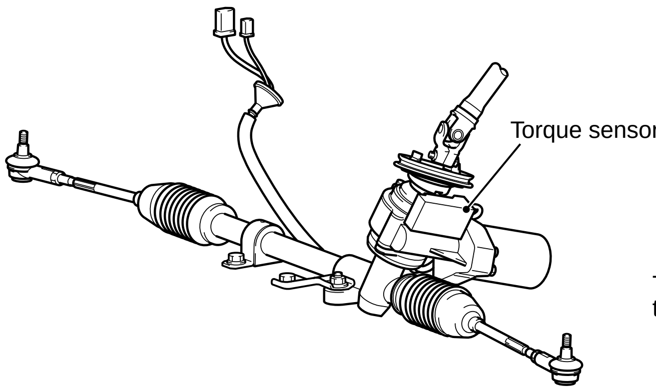


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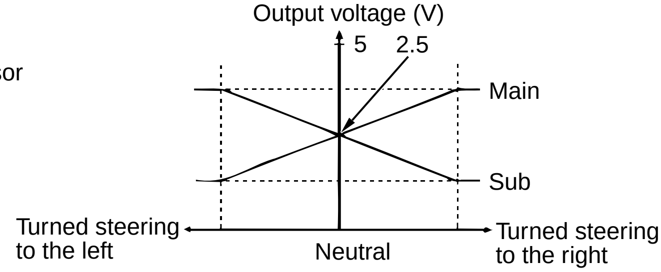
To improve operational reliability, the dual-circuit system has been adopted for the torque sensor. If any malfunction occurs in the electric power steering system, the fail-safe function of the electric power steering-ECU is activated, and the output current of the electric power steering-ECU applied to the motor is turned off. At the same time, the steering system enters manual mode, and informs a driver of the system malfunction by illuminating the warning lamp on the combination meter. The warning lamp illuminates when the following malfunctions occur: open circuit in the electric power steering system wiring harness, poor connection, malfunctions in the electric power steering-ECU, motor, or sensors.

STEERING GEAR

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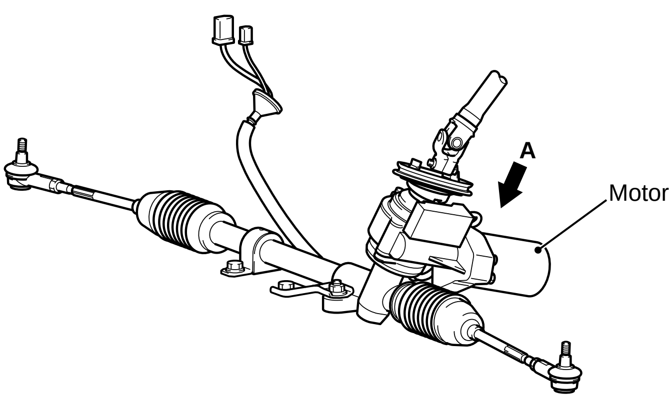


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The torque sensor which detects a operated force of the steering wheel is installed in the steering gear. When the steering wheel is turned, the steering force is detected by the torque sensor. At the same time, 2-way supply voltage signal (main and sub) are input to the electric power steering-ECU.

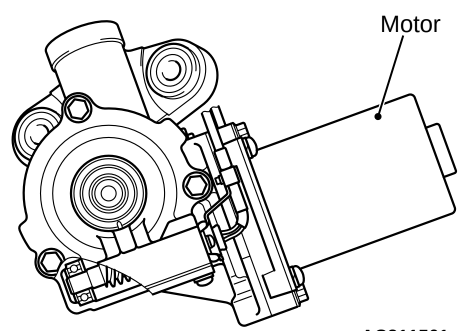
MOTOR

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View A

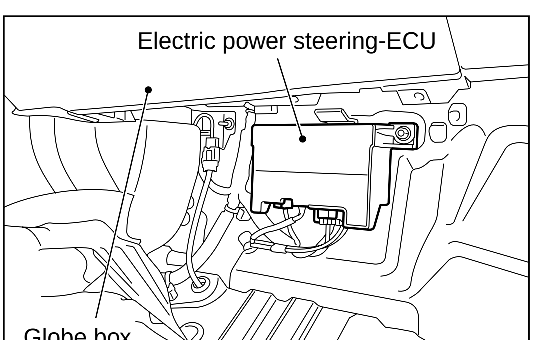


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The motor is installed in the steering gear. The steering motor is applied with a control current sent from the electric power steering-ECU and generats the assist torque to the steering gear according to the steering operation.

ELECTRIC POWER STEERING-ECU

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The electric power steering-ECU is attached below the glove box, which is integrated with an input interface circuit, a microcomputer, an output drive circuit, a fail-safe relay, and a motor line relay. etc.
It is also integrated with a self-diagnostic function, and illuminates the warning lamp and outputs diagnosis code to the diagnostic connector.

CAN COMMUNICATION

The electric power steering-ECU performs the data transfer with another ECUs through CAN communication.

Signal	Receiver ECU				
	Engine-A-M/T-ECU	ABS-ECU	Electric power steering-ECU	Meter A/C-ECU	ETACS-ECU
Motor current signal	•	–	–	–	–
Electric power steering warning lamp request signal	–	–	–	•	–

FAIL - SAFE FUNCTION

If the electric power steering-ECU detects any malfunction, it illuminates the warning lamp, deactivates the electric power steering function, and then switches the steering system into manual mode.

DIAGNOSTIC FUNCTION

Electric power steering-ECU has the following functions for easier system checks.

- Diagnosis code set
- Service data output
- Actuator test

All the above items can be diagnosed using MUT-III.

DIAGNOSIS CODE SET

There are 22 diagnostic items. Since all the diagnostic results are recorded in volatile memory (EEPROM*), they are stored in the memory even though the battery terminals are disconnected.

SERVICE DATA OUTPUT

Using MUT-III, the input data sent from the sensors and motors can be read.

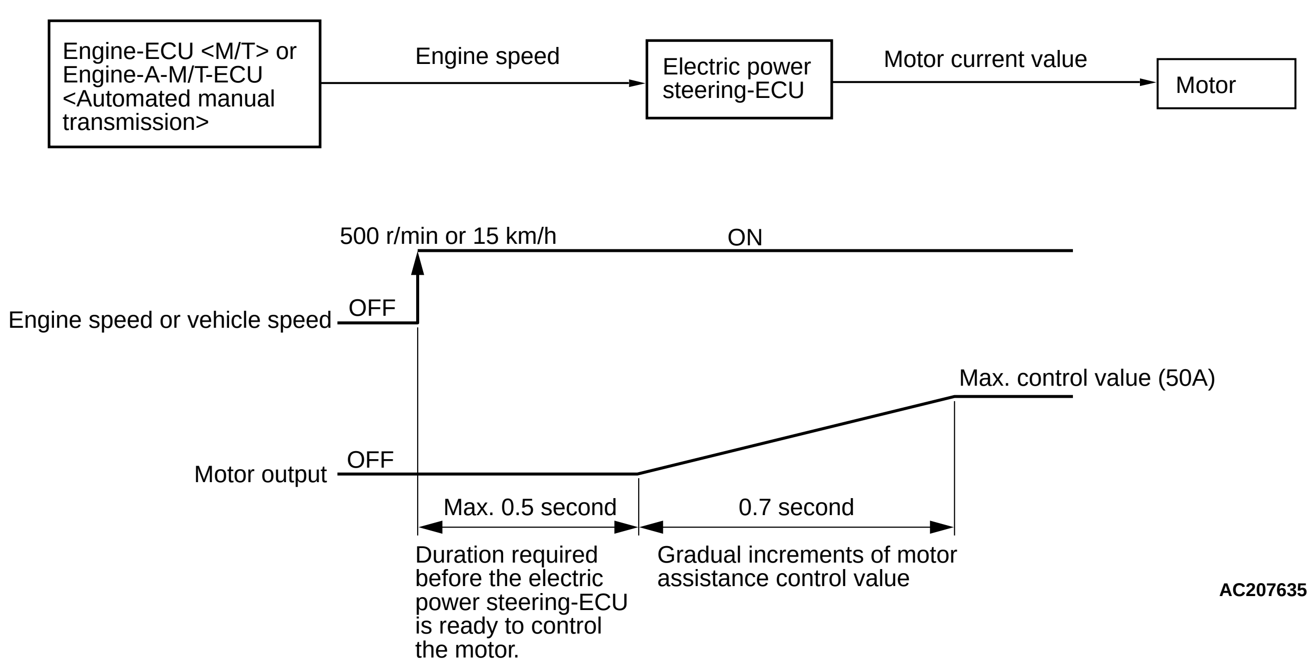
OPERATION

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IGNITION SWITCH ON

Ignition supply voltage is applied to the electric power steering-ECU, and the ECU enters standby mode.

IGNITION SWITCH ON

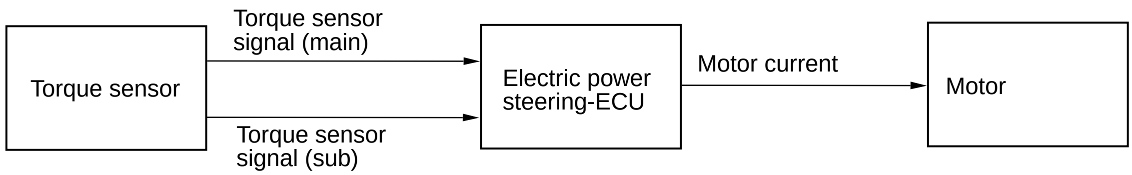


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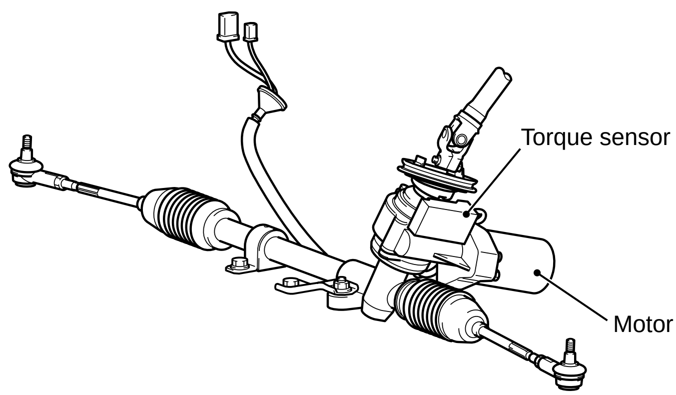
1. When the engine is started, the engine speed signal sent from the engine-ECU is input to the electric power steering-ECU.

2. After starting the engine, the electric power steering-ECU judges the engine status "ENGINE SPEED ON" when the engine speed reaches 500 rpm or the vehicle speed reaches 15 km/h or more, then the power assist function is ready.

STEERING WHEEL OPERATION



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FAIL-SAFE FUNCTION OPERATION

During the fail-safe mode, the electric power steering operates as a manual steering system.